

NASA TECH BRIEF

Marshall Space Flight Center



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Sunspot Analysis and Prediction

It is an accepted fact that a definite correlation exists between sunspot activity and aurora intensity, with recent discoveries revealing a definite correlation also existing between the density of the upper atmosphere and solar activity of the sunspot nature. Extensive literature is available on solar activity of a cyclic nature, particularly concerning the solar phenomena commonly referred to as sunspot activity, however, information is sparse pertaining to solar cycle prediction. Sunspot activity is measured according to an index called the Wolf number, and the raw data are presented in terms of monthly values for the Wolf number. This index, based on spot number and relative size, has been observed almost continuously since the middle of the eighteenth century. In connection with empiricostatistical methods of analysis and prediction, the monthly values of the Wolf number are generally smoothed over a yearly period using statistical averaging procedures. Currently, the three types of procedures for Wolf number prediction are (1) identification of parameters combined with regression analysis, (2) super-position methods, and (3) attempts at causal postulations.

The lack of accuracy and reliability of the many varied current sunspot prediction procedures has resulted in attempts to develop a more reliable prediction procedure for sunspot activity for at least one future eleven year period. Evaluation of several procedures that apply rarely used and exotic mathematical functions has yielded a unique method of application of common trigonometric functions. These functions appear to produce fruitful results in the development of a mathematical model capable of describing all the available sunspot data. Significant refinement of the model is needed but it is anticipated that the procedure can be easily modified and expanded in such a manner that it is representative of not only modern data but also ancient data dating back to 200 BC.

All existing sunspot data, both quantitative and qualitative, ancient and modern are taken into consideration in the analysis. At the present state of the art, further smoothing of modern data (1750-1970) will not decrease the accuracy of the predictions. Various graphs and tables have been developed as a result of the assigning of numerical values to data obtained previously, then graphing the maxima and minima to determine the intermediate values. Yearly Wolf numbers obtained using this procedure and the thirty-one month smoothing procedure are presented in the analysis.

Notes:

1. The information concerning this procedure may be of interest to astronomers and communication specialists.
2. Requests for further information may be directed to:
Technology Utilization Officer
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Reference: B72-10317

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to:

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Source: Dept. of Mathematics and Engineering
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